



THE ASPARAGUS RUST.

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The first knowledge of the appearance of rust upon asparagus in Indiana came to the Station through Mr. L. C. Breyfogle of Crown Point, Lake County, who sent, October 2, 1899, a specimen of asparagus thickly covered with rust, with the statement that his whole field of seven acres was in the same condition. Shortly afterward a newspaper bulletin¹ was issued from the department calling attention to the invasion of the rust and some means of guarding against it. Up to June of the present year (1900) no other locality in the State was known to be invaded by the rust, although there is reason to believe that since that date it has spread extensively.

The asparagus rust was first recorded for this country by Professor B. D. Halsted², who became aware of its presence in New Jersey in August, 1896. It was soon after found in Massachusetts by Dr. G. E. Stone³, and was probably already well distributed along the coast region from Delaware to Massachusetts, judging by subsequent investigations. On Cape Cod it appears to have existed for a year or two prior to this date,⁴ but the exact place and means of its introduction to this country are wholly unknown.

The asparagus rust is one of several kinds of rusts that have recently invaded North America from Europe and that have proved disturbing and often seriously harmful factors for the cultivator to contend with. The carnation rust, the hollyhock rust and the chrysanthemum rust are prominent among these, having received much attention from both botanists and cultivators. The asparagus rust is likely soon to force attention from every one who grows this crop, on account of its conspicuously harmful effects, although like other rust diseases, it will doubtless fail to appear some seasons, or at least remain inconspicuous. But no

¹Stuart, William—Asparagus rust, a serious menace to asparagus culture. Newspaper Bull. Ind. Exper. Sta. No. 80. Oct. 14, 1899.

²An outbreak of the asparagus rust. Issued as a circular from the N. J. Exper. Station. September 18, 1896.

³Ninth Rep. Hatch Exper. Sta. for 1896:72.

⁴Stone and Smith. The asparagus rust in Massachusetts. Bull. Hatch Exper. Sta. No. 61:5.

hope can be held out that it will ever cease hereafter to be troublesome in this country, or that it can be stamped out from even a limited region. The only outlook for the cultivator is to learn how it can be controlled and rendered the least injurious; there is no prospect of banishing it.

When asparagus is attacked by rust (*Puccinia Asparagi* DC.) it shows numerous spots along the stems, both main stems and the smaller branches, and the plants ripen prematurely, turning yellow and often becoming dry and dead many weeks before the usual time. These spots are oval or elongated, just large enough to be seen clearly without aid of a magnifying glass. They start like a blister, but soon burst open and expose a brown or a black powder. The brown powder, which consists of uredospores or summer spores, so called because serving to spread the rust during the warm months from July on, dusts out easily, and rubs off readily on the fingers. The looseness of this powder permits it to be carried away in abundance by the winds and scattered over other asparagus plants near and far, where the disease is started afresh by growth of the spores forming the powder. The black powder does not fall out or rub off readily, being formed later than the other kind, and is made up of spores intended only to grow after passing the winter and when the warmth of another growing season has arrived. It is formed of teleutospores, or so-called winter spores, which are incapable of growth until after a prolonged period of rest.

Beside these two kinds of spores, which are not always told apart with certainty except by help of a microscope, there is another kind, the aecidiospores, or so-called spring spores. These are quite unlike the other two kinds, being bright yellow and formed in minute whitish cups just large enough to be seen by the unaided eye, and usually appearing in groups. This form of the rust is frequently called the cluster-cup stage. It appears from May to July. So far, this stage seems to be rarely produced in this country, and were it not that it has an important relation to the vigor and therefore the harmfulness of the rust it might be ignored. The fewer cluster-cups produced, the less will be the intensity of the disease that season, compared to what it would have been had more cluster-cups been formed. This does not mean, of course, that the fewer the cluster-cups the less rust, because the amount of rust depends upon the summer spores and a state of the weather encouraging their spread and growth, but it means that whatever the amount of rust it will be

deprived of some of its power of injury the fewer cluster-cups that precede.

There are three direct ways of combatting the asparagus rust: (1) destroy the spring spores, which can be done best by hand-picking, as they are usually few; (2) spray frequently with fungicide for a month or two, beginning when cutting stops, in order to prevent both spring and summer spores carried through the air from growing on the surface of the plants to start the disease, and (3) destroy the winter spores by burning over the ground in autumn, or by some other means, thus preventing germination the next spring.

The first of these methods needs no explanation, except to suggest that the careful cultivator will take considerable pains to keep a close watch for cluster-cups and see that they are destroyed, which means annihilated by burning, not thrown on the ground to wither.

The second method has been tried by the New Jersey and New York Stations and so far without large success. Their experiments show that the standard Bordeaux mixture is somewhat too strong for asparagus, making it better to use a weaker solution, and that owing to the difficulty of making the solution adhere some resin should be added to it.

When the sprayings are done at short intervals, about a week or less, so that the rapidly growing shoots do not become infected between sprayings, a considerable reduction of the rust has been obtained, but whether this will warrant the commercial application of the method is not yet fully determined.

The third method is readily applied in the main, although to be certain of destroying all the winter spores in a field presents difficulties. If the dead tops are gathered into piles and burned, many spores are destroyed, but also many of the smaller branches well covered with rust will be scattered over the ground and escape. On the other hand, the whole field may be burned over without cutting. There is danger in this method that the tops will not be thick enough in places, or the heat intense enough to burn all the rusted material, especially when some of the tops are still green. To obviate this difficulty straw may be distributed over the field in quantity to insure thorough action of the flames. The burning should be done late in the season, after growth has ceased, for not only will there be more difficulty earlier in making all the material burn, but checking the fall ripening of the underground buds will weaken the next season's growth and conse-

quently cause a greater number of small shoots to start. Stirring the surface soil in fall after burning or as early in the spring as possible, so as to bury, however slightly, the bits of rusted debris will be an additional safeguard. The free use of lime or salt on the field will also tend to prevent the germination of the spores.

There are indirect methods that may be used effectively against the rust. It has been observed by Professor Halsted,⁵ of the New Jersey Station that in their grounds two varieties were much less affected by rust than the others, eight varieties in all being tested. The Palmetto had scarcely more than half as much rust as the others, excepting a French variety, the Giant Argenteuil, not yet much grown, which had only a third as much rust. The last, however, was not in fair growth for the test, as it was from seed, and seedlings are generally less susceptible than older plants of the same variety. The selection of rust resisting varieties may possibly prove a feasible method of reducing loss from this disease, although it cannot yet be asserted with much confidence.

Another indirect method is to select soil that will supply abundance of moisture during mid-summer, or when possible arrange to irrigate during the dry part of the season. This suggestion is based upon the observation of Dr. Stone⁶ of the Massachusetts Station, who found that the injury from rust was far greater in fields with light porous soil incapable of retaining soil moisture during dry periods. The reason for this lies partly in the fact that the rust breaks open the surface tissues of the asparagus plants and thus allows the moisture from the inside of the plants to escape readily, in the same manner as puncturing the surface with needles would do. The plant is thus deprived of moisture faster than the roots can supply it from a deficient soil, and the plants are unable to make suitable growth. It is also claimed that plants making continuously vigorous growth are less attacked by rust than those permitted to be checked through lack of moisture for the roots. Altogether the evidence points to a decided advantage in lessening the injury from rust by providing the conditions that ensure a strong and continuous growth of the plants.

Another indirect method of controlling the rust is to take pains

⁵ Twentieth Rep. N. J. Exper. Sta. for 1899 : 411. •

⁶ The relationship existing between the asparagus rust and the physical properties of the soil. Twelfth Rep. Hatch Exper. Sta. for 1899 : 61-73.

to remove all scattered plants of asparagus growing in hedge-rows, fields or elsewhere in the vicinity. If this is not done, they become centers for the distribution of rust spores and the propagation of the disease. The distance which spores may be carried by the wind is undoubtedly very considerable and careful attention to a field may be rendered quite ineffective by infection from stray plants.

A natural check to the rust occurs in fungous parasites that grow and feed upon the spores. There are two of these known, one of which (*Darlucula filum* Cast) has been observed in Indiana. There is no method known, however, by which it can be propagated or fostered.

SUMMARY.

Asparagus rust, first certainly noticed in this country in 1896, has appeared in Indiana.

The rust promises to do considerable injury to the asparagus crop, at least during some seasons.

The rust has three kinds of spores, the spring spores, which are rarely formed; the summer spores, which serve to spread the disease rapidly; and the winter spores, which carry the infection over the winter.

Direct methods of controlling the rust are to destroy the spring spores as they appear by hand-picking, spray frequently after spring cutting is finished to prevent spread of the disease, and burning the plants in autumn to destroy the winter spores.

Indirect methods are to select rust-resisting varieties, if such there be, and provide moisture to ensure good growth of plants during dry periods, if this be feasible.

